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IS 6217 (1982): Specification for Short Link Chain, Grade S (6), Non-calibrated for Lifting Purposes [MED 14: Cranes, Lifting Chains and Related Equipment]



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IS : 6217 - 1982

*Indian Standard*  
SPECIFICATION FOR  
SHORT LINK CHAIN, GRADE S (6),  
NON-CALIBRATED FOR LIFTING PURPOSES  
( *First Revision* )

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INDIAN STANDARDS INSTITUTION  
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG  
NEW DELHI 110002

# Indian Standard

## SPECIFICATION FOR SHORT LINK CHAIN, GRADE S (6), NON-CALIBRATED FOR LIFTING PURPOSES ( First Revision )

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# *Indian Standard*

## SPECIFICATION FOR SHORT LINK CHAIN, GRADE S (6), NON-CALIBRATED FOR LIFTING PURPOSES

### *( First Revision )*

#### 0. FOREWORD

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 26 February 1982, after the draft finalized by the Lifting Chains and Associated Fittings and Components Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

**0.2** This standard was first published in 1971. This revision has been necessitated to rationalize the nominal sizes of the chains to bring them in line with international practice. Moreover, under mechanical properties, the minimum energy absorption factor has been deleted and in place of guaranteed minimum elongation at fracture, the concept of minimum total ultimate elongation has been introduced.

**0.3** In the preparation of this standard considerable assistance has been derived from ISO 3075-1980 'Short Link Chain for Lifting Purposes—Grade S (6), Non-calibrated, for Chain Slings, etc. ', issued by the International Organization for Standardization ( ISO ).

**0.4** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960\*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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#### 1. SCOPE

**1.1** This standard covers the requirements for lifting chains, Grade S (6) non-calibrated, for use on cranes, in chain slings and for general lighting

\*Rules for rounding off numerical values ( revised ).

purposes. These are electrically welded round steel short link chains fully heat-treated and tested and comply with the general conditions of acceptance of IS : 5616-1982\*.

The sizes from 5 to 45 mm are covered in this standard.

## 2. TERMINOLOGY

**2.1** For the purpose of this standard the definitions given in IS : 5616-1982\* shall apply.

## 3. DIMENSIONS

**3.1 Material Diameter ( $d$ )** — The material diameter defined and measured in accordance with the requirements of IS : 5616-1982\* shall be as given in Table 1.

**3.1.1 Tolerances on Material Diameter** — For sizes up to and including 16 mm, the diameter,  $d$ , of the material in the finished link shall nowhere differ from the nominal diameter by more than  $+ 0.5$  mm or  $- 6$  percent except at the weld.

For sizes 18 mm and over, the diameter,  $d$ , of the material in the finished link shall nowhere differ from the nominal diameter,  $d_n$ , more than  $\pm 5$  percent, except at the weld.

**3.1.2 Tolerance at the Weld** — The dimensions of the steel at the weld shall nowhere be less than the diameter,  $d$ , of the steel adjacent to the weld, nor exceed it by more than following:

Type 1 : 10 percent of the nominal diameter in any direction;

Type 2 : 20 percent of the nominal diameter in any direction; and

Type 3 : 20 percent of the nominal diameter in the direction perpendicular to the plane of the link, and 35 percent in other planes.

NOTE — Type 1 eliminates functional problems such as kinking or locking by severely limiting the weld oversize to 10 percent of the nominal diameter. Types 2 and 3 ensure freedom from these hazards by allowing the oversize beyond the 10 percent allowed under Type 1 to certain areas of the link only ( see Fig. 1 ), thus providing clearance where required.

**3.1.3 Area Affected Dimensionally by Welding** — The weld or welds are positioned in the centre of one or both legs of the link. The area affected dimensionally by welding shall not extend by more than 0.6 times the material diameter to either side of the link.

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\*Specification for short link chain for lifting purposes : General condition of acceptance ( first revision ).



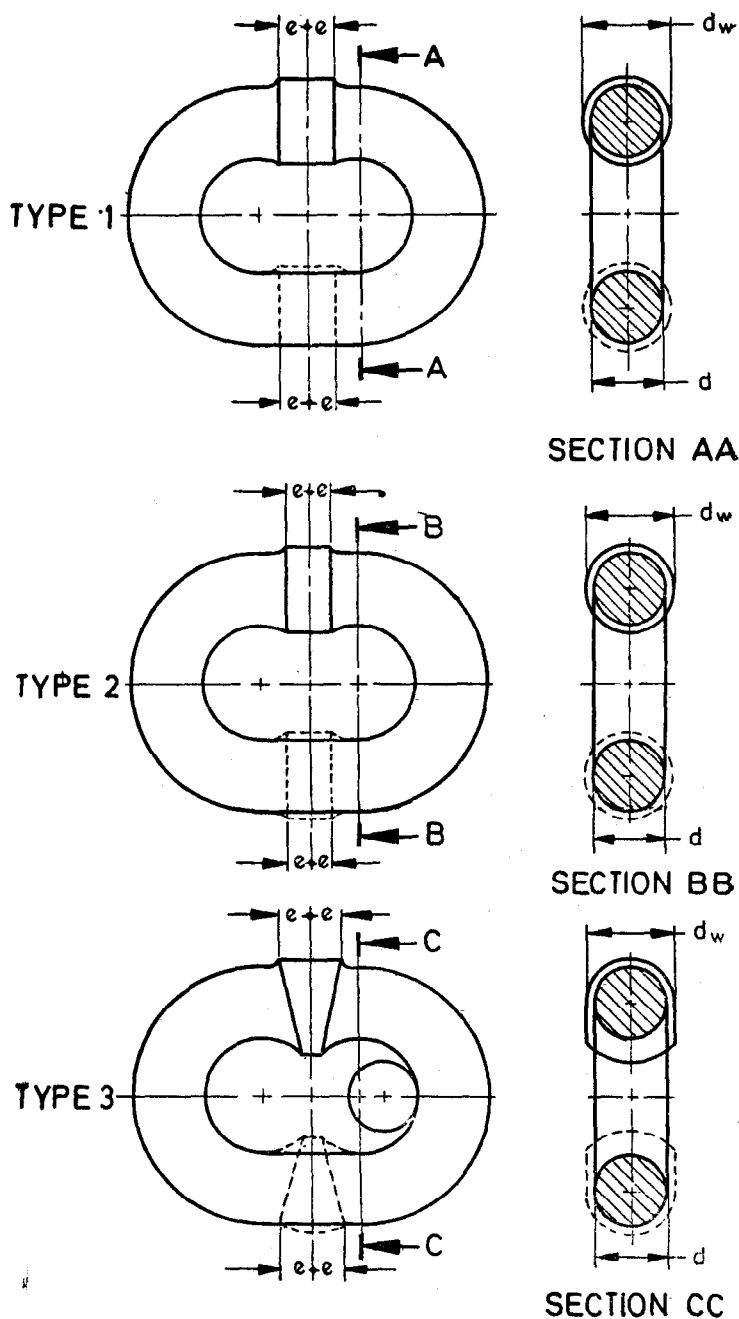
**TABLE 1 DIMENSIONS OF GRADE S (6) NON-CALIBRATED CHAIN**

( Clause 3.1 )

All dimensions in millimetres.

NOMINAL SIZE	DIAMETER TOLERANCE ( $d - d_n$ )	MAXIMUM TOLERANCE AT THE WELD			OUTSIDE LINK LENGTH LIMITS		OUTSIDE LINK WIDTH AWAY FROM WELD, W Max ( $3.5 d_n$ )
		TYPE 1	TYPE 2	TYPE 3	Max ( $5 d_n$ )	Min ( $4.75 d_n$ )	
		( $d_w - d$ )	( $d_w - d$ )	( $G - d$ )			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
5	+ 0.5 - 0.30	0.5	1.0	1.75	25	24	18
6	+ 0.5 - 0.36	0.6	1.2	2.1	30	28	21
7.1*	+ 0.5 - 0.43	0.71	1.42	2.5	36	34	25
8	+ 0.5 - 0.48	0.8	1.6	2.8	40	38	28
9*	+ 0.5 - 0.54	0.9	1.8	3.15	45	43	32
10	+ 0.5 - 0.60	1.0	2.0	3.5	50	47	35
11	+ 0.5 - 0.66	1.1	2.2	3.85	55	52	39
12	+ 0.5 - 0.72	1.2	2.4	4.2	60	57	42
14	+ 0.5 - 0.84	1.4	2.8	4.9	70	66	49
16	+ 0.5 - 0.96	1.6	3.2	5.6	80	76	56
18	± 0.90	1.8	3.6	6.3	90	85	63
20	± 1.0	2.0	4.0	7.0	100	95	70
22	± 1.1	2.2	4.4	7.7	110	104.5	77
25	± 1.25	2.5	5.0	8.75	125	119	88
28	± 1.4	2.8	5.6	9.8	130	133	98
32	± 1.6	3.2	6.4	11.2	160	152	112
36	± 1.8	3.6	7.2	12.6	180	171	126
40	± 2.0	4.0	8.0	14.0	200	190	140
45	± 2.25	4.5	9.0	15.75	225	214	158

\*These sizes shall be supplied subject to agreement between the manufacturer and the purchaser.



$d_n$  = Size ( nominal diameter of the material ),  
 $d$  = Measured diameter of the material except at the weld,  
 $d_w$  = Measured diameter of the material at the weld ( Type 1 and 2 welded chain )  
 or weld dimension perpendicular to the plane of the link ( Type 3 welded chain ),  
 $G$  = Dimension in other planes ( Type 3 welded chain ), and  
 $e$  = Length affected by welding on either side of the centre of the link.

For all welds

$$e \leq 0.6 d_n$$

$$\text{For } d_n \leq 16 \text{ mm, } d = d_n + 0.5 \text{ mm} \\ - 6\%$$

$$\text{For } d_n > 16 \text{ mm, } d = d_n \pm 5\%$$

Weld tolerances:

$$\text{Type 1 : } d_w = d + 0.10 d_n \\ 0$$

$$\text{Type 2 : } d_w = d + 0.20 d_n \\ 0$$

$$\text{Type 3 : } d_w = d + 0.20 d_n \\ 0$$

$$G = d + 0.35 d_n \\ 0$$

FIG. 1 MATERIAL AND WELD TOLERANCES

**3.2 Length and Width** — The outside dimensions of the links shall fall between the following limits ( see Fig. 2 ):

Length ( $l$ ) — Not more than 5 times and not less than 4.75 times the size.

Outside width ( $w$ ) — Not more than 3.5 times the size, except at the weld. At the weld, not more than 1.05 times the adjacent width.

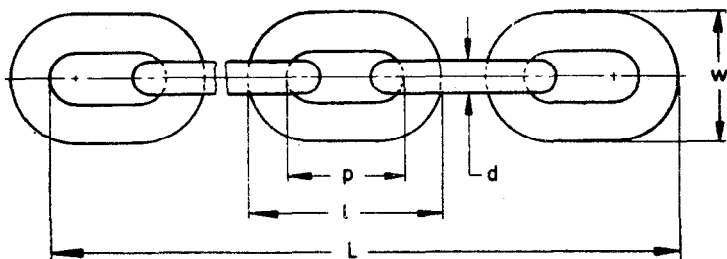


FIG. 2 CHAIN AND LINK DIMENSIONS

#### 4. MATERIAL

**4.1** The steel used shall be produced by the open hearth or electric process, or by an oxygen-blown process.

**4.1.1** In its finished state, as supplied to the chain maker, it shall meet the following requirements as determined by check analysis on the rod, wire or finished link.

**4.1.2** It shall be an alloy steel of reliable welding quality capable of being heat-treated to produce the mechanical properties required.

**4.1.3** It shall be fully killed and shall contain alloying elements in sufficient quantities to guarantee the mechanical properties of the chain after appropriate heat treatment. The alloy steel used shall contain at least one of the following alloying elements or their equivalent:

Nickel,  
Chromium, and  
Molybdenum.

Neither manganese nor silicon shall, in this context, be considered as alloying elements.

**4.1.4** Its content of sulphur and phosphorus shall be restricted as follows:

	<i>Cast Analysis</i> ( percent )	<i>Check Analysis</i> ( percent )
Sulphur ( <i>Max</i> )	0.035	0.04
Phosphorus ( <i>Max</i> )	0.035	0.04

**4.1.5** The steel shall be made in conformity with fine grain practice to give an austenitic grain size of 5 or finer when tested in accordance with IS : 2853-1964\*. This could be accomplished by ensuring that it contains sufficient aluminium, or an equivalent element, to allow the manufacture of chains stabilized against strain age embrittlement during service; a minimum value of 0.02 percent metallic aluminium is recommended for guidance.

**4.2** Within the above limitation it is the responsibility of the chain maker to select a steel, so that the finished chain, suitably heat-treated, meets the specified mechanical properties.

## **5. HEAT TREATMENT**

**5.1** All chain shall be hardened and tempered before being subjected to the proof force.

## **6. PROOF FORCE**

**6.1** After manufacture, heat treatment and other processing, the finished chain shall be subjected to the proof force given in Table 2 and shall be applied as specified in IS : 5616-1982†.

## **7. TEST REQUIREMENTS**

**7.1** Actual test force to be applied to each size are given in Table 2. The mechanical properties required of this grade of chain are summarized in Table 3.

**7.2 Selection of Samples** — Samples shall be selected as specified in IS : 5616-1982\*. The length of the lot from which a sample is selected by the inspector shall be 200 m or part thereof.

### **7.3 Static Tensile Test**

**7.3.1** The breaking force determined in accordance with IS : 5616-1982\* shall not be less than that specified in Table 2.

\*Method of determining austenitic grain size of steel.

†Specification for short link chain for lifting purposes: General condition of acceptance (*first revision*).

**TABLE 2 GRADE S (6) TEST REQUIREMENTS AND LIFTING CAPACITIES**( *Clauses 6.1, 7.1, and 7.3.1* )

NOMINAL SIZE $d_n$	PROOF FORCE TO WHICH THE WHOLE CHAIN IS SUBJECTED	MINIMUM BREAKING FORCE	WORKING LOAD LIMIT
(1)	(2)	(3)	(4)
mm	kN	kN	tonnes
5	12.4	24.8	0.63
6	17.9	35.8	0.9
7.1	25.0	50.0	1.25
8	31.7	63.4	1.6
9	40.1	80.2	2.0
10	49.5	99	2.5
11	60	120	3.0
12	72	144	3.6
14	99	198	5.0
16	127	254	6.3
18	161	322	8.0
20	198	396	10.0
22	244.5	489	12.5
25	314	628	16
28	393	786	20
32	507	1 014	25
36	642	1 284	32
40	792	1 584	40
45	1 002	2 004	50

**7.3.2 Total Ultimate Elongation** — The total ultimate elongation as defined in IS : 5616-1982\* shall not be less than 17 percent.

## 8. INSPECTION

**8.1 Acceptance Procedure** — The acceptance procedure specified in IS : 5616-1982\* shall be followed to determine the acceptability or otherwise of the chain.

\*Specification for short link chain for lifting purposes : General condition of acceptance (*first revision*).

TABLE 3 MECHANICAL PROPERTIES

( Clause 7.1 )

MECHANICAL PROPERTY	REQUIREMENT
(1)	(2)
Mean stress at specified minimum breaking force $\frac{2 F_m Min}{\pi d_n^2}$	630 MPa ( N/mm <sup>2</sup> )
Mean stress at proof force $\frac{2 F_c}{\pi d_n^2}$	315 MPa ( N/mm <sup>2</sup> )
Ratio of proof force to specified minimum breaking force	50 percent
Specified minimum total ultimate elongation	17 percent
Mean stress at working load limit	157.5 MPa ( N/mm <sup>2</sup> )

NOTE — The stresses quoted in this table are obtained by dividing the load by the total cross-section of both sides of the link, that is, they are mean stresses. The stress is in fact not uniform, and particularly at the extrados the maximum fibre stress is considerably greater.

## 9. MARKING

**9.1 Quality Marking** — The chain shall be marked with ' S ' or ' 6 ' in a circle that is, (S) or (6) as recommended in IS : 5616-1982\*

**9.2 Identification Marking** — The identification marking shall comply with the requirements of IS : 5616-1982\* for every supply of chain.

**9.3 Inspection Marking** — Inspection marking shall comply with the requirements of IS : 5616-1982\*.

## 10. TEST CERTIFICATE

**10.1** The manufacturer shall supply a certificate of test and examination with every supply of chain. A typical form is given in Appendix B of IS : 5616-1982\*. The certificate shall give the following information:

a) Name of the chain maker,

\*Specification for short link chain for lifting purposes: General condition of acceptance ( first revision ).

- b) Grade of material,
- c) Size of chain,
- d) Identification marking,
- e) Proof force applied to the whole chain,
- f) Number of test samples taken,
- g) Breaking force of each sample, and
- h) Total ultimate elongation.

**NOTE** — All testing shall be done in the presence of a competent person or in an approved testing establishment.

# INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

## Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

## Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

## Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s <sup>2</sup>
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m <sup>2</sup>
Frequency	hertz	Hz	1 Hz = 1 c/s (s <sup>-1</sup> )
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m <sup>2</sup>

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